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PHOTOGRAPHING INTERIORS.

THE great difficulty encountered in the photographing of interiors by daylight is in the securing of harmonious illumination; certain portions adjacent to the strong light streaming in from windows opening on the street or court-yard receive the allopathic dose of light, whilst others get the homœopathic thousandth dilution.

I say nothing about the windows themselves, since photographers who have had much experience can alone do justice in the denunciation of the great enemy of interior photography, halation. I know all about the various devices which have been suggested to overcome both irregular illumination and halation, but these remedies demand the wholesale sacrifice of light,—just what is needed most of all in an interior, and the consequent loss of time, the greatest count to the practical photographer. Good exposure on interiors with daylight is often out of the question if one wishes to have a soft, pleasing picture; but thanks to the march of improvement we are independent of the sunlight, who never seemed to care to work for us satisfactorily when we wanted him to come in out of doors and scour around the corners of dark rooms.

Since the introduction of the new magnesium light it is possible to shut up all the windows and yet produce results quite equal, and in many cases far superior, to anything obtained by daylight. Minutes, or rather seconds, will now do better work than formerly was secured by exposure of hours' duration.

I remember in the days of wet photography being sent to photograph an exhibit at the Centennial Exposition.

After preparing the special collodion necessary for long exposures—that is, treating it to as much water, drop at a time, as it would carry—I coated a plate therewith, and started for the scene of action. The situation of the exhibit was in a rather dark corner, and I calculated that it would take at least an exposure of half an hour.

My camera was set up—not a very easy task (a 20x24 size)—the focusing accomplished by mounting a step-ladder, the holder placed in position, and the slide drawn. I now determined, while the chemicals and the lazy light were doing the work, that I might rest from my labors and let my works follow me, the

time being near the close of a warm summer day. Either monotony of the exhibit (piles of cheeses, arranged by some æsthetic eye in columns and arches), or the odor arising therefrom, or weariness, or all combined, caused me to fall into a peaceful doze. How far I had traveled in the land of dreams I know not. All I knew at the time was the call to consciousness by the rough salute of the guard, that closing time had come, and the certain feeling that my exposure was either ruined by overtime, or the drying of the collodion film.

My traps were soon in order, and my march made double-quick for the dark-room. Thanks this time to the slow light and the slow plate I found I had a most beautiful negative, only regretting that techique had not expended itself upon something more beautiful.

Had I possessed the means at present so abundant for securing exposures in dark corners, I might have made my exposure, and afterwards taken "my rest at my ease in my inn."

The facility with which exposures on interiors may be made with magnesium light ought to make it more popular with practical photographers, but they seem to have such an enormous share of conservatism that they are afraid of anything championed by the enterprising amateurs.

The only objection to magnesium is in the fumes; but these are not serious, and the householder seldom or never objects.

Pure magnesium in powder may be used, or the flash-light compounds. The latter have the advantage of accomplishing the work in a much shorter time, a fraction of a second being sufficient to secure a beautifully exposed negative, with a single charge of the powder. Generally when pure magnesium is used two or more charges are necessary, and of course it would be impossible to secure figures in the picture without showing signs of motion.

The addition of figures adds very much to the life and beauty of photographs. A domestic scene, consisting of the family at their usual pleasures or tasks, takes away the idea of desolation which the average interior picture conveys.

It is true that several simultaneous charges of pure magnesium could be ignited in different parts of the room, and so augment the quantity of actinic influence, but the conflicting shadows so produced, cross-shadows as they are called, give a very unpleasant, not to say unnatural, appearance to the picture. So I generally make use of the blitz-pulver compound, which requires less material and is more brilliant, though more noisy in its work.

It requires some judgment in determining where to locate the source of illumination so as to properly light up the objects and to cast the shadows in the right direction.

I have found it advantageous to place the source of light rather high up, so as to avoid the formation of lengthened shadows on the floor.

Care must be taken that the flash is not so placed as to cause violent reflection from polished objects, and special precaution observed to keep mirrors from reflecting the light into the lens.

The reflections from china and glass are most beautifully rendered by the magnesium flash, and if the source of illumination is properly managed, the reflection in the mirrors of the objects in the room adds much to the effect.

By the use of the magnesium light it is possible to obtain in the picture the view of other rooms through doorways, etc. Vista after vista may be secured with very little additional trouble.

An exposure is first made upon the principal room, the cap placed on the lens, and a smaller diaphragm used to secure the proper definition in the outer room, the cap is then removed, and a charge of powder ignited in a part of the outer room where the light will not flash in the lens. In this way several exposures may be made upon the same plate.

I have obtained some very pretty effects by first securing views out of the window of the surrounding landscape, with hills, fields and cottages, then drawing the curtain and exposing the room by means of a flash. Of course a very small stop is used in getting the landscape, so care must be taken to remove this and to substitute a larger one when exposing for the interior.

The lens I employ is a Ross Portable Symmetrical, a most excellent instrument for interior work, and especially for flash-light interiors, combining considerable angle with great rapidity, and perfect definition.

Some difficulty will be encountered in focusing interiors by reason of the faint illumination. I always make use of a candle to illuminate a printed page of a book or newspaper. By getting the type sharply defined I am sure that the objects in its plane are also sharp. The lighted candle is also very useful in determining the limits of the picture; by moving it to the right and left it is easy to see just where your picture stops. I also have an assistant move it along the base-line of my picture on the ground-glass, and when it moves along without any eclipse I am sure that nothing in my foreground will come too obtrusively into the view. When the image of the candle disappears I know that some object is in front which ought not to be there, so its removal is at once effected.

A word about the groups in a picture of a room. The figures should always be so arranged that the impression is given of life and animation. All set-posing, as if the people were lay-figures, must be avoided.

The figures are best arranged in groups of two or three, as if engaged in conversation, or occupied with some amusement. In this way I have disposed of ten or a dozen people in one view, and the effect is much more pleasant and picturesque then when the arrangement is in the form of a pyramid, or any other set artistic disposal.

W. R.

MOUNTING, AND THE SURFACES OF PRINTS.

IT is a gratifying proof of the interest shown in photographic matters by our modern practitioners, that old processes are being revived, almost unearthed, we might say, and worked side by side with the most recent refinements and improvements.

An instance of this, which has just come under our notice, is the re-introduction of a well-known process for obtaining prints on rough-surfaced paper, the details being as follows: Drawing-paper is salted with a proper salting solution containing enough gelatine to size the surface, and is afterwards sensitized with ammonio-nitrate of silver applied with a cotton brush. The paper is not fumed, but simply well dried

and printed as usual. It is toned in a carbonate of soda bath, and fixed. It is mentioned as a strong point in favor of this process, that "tones resembling those of the platinum print may be obtained." We can strongly recommend the process to those whose artistic feelings are wounded at the glossy surfaces of the albumen, gelatino-chloride, collodio-chloride prints, etc. But let us add that the process will be found most suitable for subjects that present bold contrasts of light and shade without much fine detail. In portraiture, for example, we should select a negative lighted in the so-called "Rembrandt" manner, and one of large size, rather than a small one full of delicate detail.

The surface, or rather the absence of surface, of prints thus made, will depend upon the grade of paper selected. Whatman's papers have been recommended as possessing every requisite quality. Now, in common with the platinum, plain silver, and blue prints, these prints on drawing paper offer the great advantage over those made on albumen, gelatino-chloride, etc., that they are *non-contractile* and may be easily mounted, without risk of injury to the surface of the picture. It is a matter of common observation among those who have had experience in printing on albumenized paper, that after the print is finished, the surface is more or less covered with minute cracks. In some cases this constitutes a very unsightly defect. If the paper is highly albumenized, and the weather, when the prints made, very cold and dry, and the prints hurriedly dried in a hot room after removal from the last wash waters, it may be impossible to obtain a good smooth surface free from cracks, even if the print be thoroughly rolled. As a general thing, however, the commercial brands of albumenized paper have too little albumen on the surface to behave in this manner, and there is rather a general want of brilliancy, than any defect owing to a too-heavily albumenized surface.

Should any of our readers be troubled in this manner, they will be able to improve matters by adding a little pure glycerine to the last wash. The exact quantity to be added, of course, would have to be determined by experiment; an ounce to the quart might be used to start with. After the prints have been thoroughly soaked in this, they should be lifted out, placed together back to back, and dried in this position by means of spring clothes-clips. As each print exerts traction upon the other, both will dry quite flat, and the small quantity of glycerine will remove the obstinate tendency to curl and prevent the albumen surface from becoming unduly dry and cracking.

Some operators insist that the prints be mounted while still wet, in order to prevent cracking of the surface, but this necessitates that the prints be finally trimmed before the washings and handlings, which seldom fail to fray and disfigure the neatness of the corners and edges. The best reason for pursuing this plan, to our minds, would be that the mounted print could be passed through the rolling-press, while the albumen surface still retained sufficient moisture to render it pliable and compressible under the heavy pressure. If the prints were first dried and then re-wetted before mounting, it is evident that the same end would not be effected.

Anyone who has had to mount large batches of prints knows very well how much the work is expedited by wetting them. Those nearly of a size are brought together face down and laid on a sheet of glass. A large, soft towel is dabbed over the back of each print until the superfluous moisture is removed, and the gelatine then quickly

laid on with a flat hog's hair blender. The card being ready, all that remains to be done is to pass the point of a knife under the upper print, lift it off, and apply it to the card. A clean sheet of blotting paper is then laid over, and a few passes with the hand finish the operation. The print, it will be seen, requires no holding with the hand during the pasting, and there is no possibility of the gelatine getting on the surface of any of the other prints. The cards, however, will always cockle badly when the prints are thus mounted, unless dried under pressure between blotting papers.

The surface of the aristotype and other papers in which gelatine is employed in sufficient amount to give great gloss, is by far more difficult to manage than the albumen surface. Authorities are somewhat divided as to the manner in which the finished print should be treated. Dr. J. Schnauss, in the *Archiv*, says, "I have abandoned the practice of mounting prints wet, whether made with collodion or gelatine, but particularly the latter. I do not advise the employing of a warm gelatine solution for mounting gelatine prints, because the gelatine surface becomes very much softened and so sticky that it requires the greatest care to finish the work without injury to the film. In my hands the best method has been to dry the picture as flat as possible, and mount it with a rather thin, cold paste made of rice starch. The most brilliant aristotype prints may be mounted in this manner, as well as those on collodio-chloride paper."

Dr. Schnauss then proceeds to say that prints on albumenized paper should be mounted wet. We have already sufficiently discussed this point, but let us add that neat results may be had when prints are to be mounted in albums, if they are first *slightly rolled*, not too much, so as to crush the substance of the paper, and then mounted in with the well-known alcoholic solution of gelatine. By placing a sheet of clean, thick blotting paper between each pair of leaves and keeping the album under pressure, there will be little or no cockling of the leaves when the work is finished.

ELLERSLIE WALLACE.

CHEMICAL CHANGES FROM THE MODERN POINT OF VIEW.

Read at the Conference of the London Camera Club.

THE development of the science of energy and the establishment of the great principle of the Conservation of Energy, following upon that of the Conservation of Matter, has naturally exerted great influence on the development of chemistry and on the attitude of present-day chemists towards the problems with which they have to deal. The application of what are commonly called physical methods to the solution of chemical problems is becoming more and more frequent, and it may now be taken as recognized that, so far as it is possible to draw a distinction between them, experimental physics is the mechanics of masses and molecules, whilst chemistry is essentially the mechanics of the atoms.

It is not possible, in the time at my disposal, nor would it be desirable before this audience, to enter upon anything like a complete technical discussion of this aspect of the subject. All I can attempt is to indicate in a very general way the character of the phenomena, and the nature of the considerations which have to be taken into account. Chemical changes which seem to be simple present a considerable

degree of complexity when they come to be closely examined, and many of the reactions with which we, as photographers, have to deal, are of a particularly complicated character, and their proper investigation involves more than an elementary knowledge of physics and chemistry, if, indeed, their solution is possible at all in the present condition of our knowledge. It is probably too much to hope that this paper will do anything towards checking or improving the hopelessly inaccurate chemical speculation, and the loose and unscientific treatment of chemical problems which unfortunately, characterizes so much of the photographic literature in this country and in America ; but if that result were to follow, even in a small degree, any trouble which the preparation of this paper has involved would be amply repaid.

The modern view of chemical changes is, in a word, a dynamical view, and the adoption of physical methods has necessarily led to the adoption of physical phraseology. It will, therefore, be convenient to define at once some of the terms which we shall frequently have to use. A *system* is a body, or a group of bodies, to which, for the purpose of our investigation, we exclusively confine our attention ; it may be of any magnitude we please, and may consist, say, of a single molecule of water or may include the whole solar system. The *configuration of a system*, at any given instant, is the relative arrangement of all the parts of the system at that instant.* The *velocity* of a reaction is the rate at which chemical change takes place, and is measured by the quantity of a given substance formed or decomposed in unit time. The *limit* of a reaction is the amount of change which has taken place when a condition of equilibrium is established and the reaction ceases; it is generally expressed as a percentage of the total change theoretically possible.

Complete knowledge of a chemical change involves a knowledge of the initial and final distribution of matter, as indicated by the composition and quantities of the reacting bodies and the products; and a knoweldge of the initial and final distribution of energy as deduced from the distribution of the matter, and from the quantity of energy which is liberated or absorbed in the form of heat or electricity during the reaction. It also involves a knowledge of the conditions under which the change will take place, its velocity, and its limit; and of the way in which these quantities are affected by the temperature, concentration, and relative masses of the reacting substances.

Every chemical change is so intimately associated with physical changes, that we are obliged to consider them in connection with each other, and in some cases find it very difficult to distinguish between them. In many cases the velocity and limit, the direction, and even the very occurrence of a reaction, are dependent upon the physical conditions. This has been recognized for some time. If, for example, a solution of ammonium carbonate is added to a solution of calcium chloride, calcium carbonate is precipitated and ammonium chloride remains in solution ; but if, on the other hand, solid calcium carbonate is heated with solid ammonium chloride, ammonium carbonate is volatilized and calcium chloride is left behind. The direction of the change is determined in the first case by the insolubility, and in the second case by the volatility, of one of the products, which removes it from the sphere of action, and thus prevents anything of the nature of a reverse reaction.

It has long been known that the occurrence or non-occurrence of a chemical

* Maxwell, "Matter and Motion."

change is dependent not only on the nature of the substances which are brought together, but also on the temperature. Sulphur, for example, remains unaltered in the air at the ordinary temperature, but takes fire if heated. It has recently been found, however, that the presence or absence of very minute quantities of certain substances may exert a very great influence. Dry carbonic oxide will not burn in perfectly dry air or oxygen, and a mixture of the two gases will not explode unless a minute quantity of water is present ; perfectly dry sulphur, carbon, and even phosphorus, will not burn, in the ordinary sense of the word, in dry oxygen. We have, of course, analogous phenomena in the case of those silver compounds which are not affected by radiation except when in contact with the various reducing agents which we call sensitizers. A satisfactory explanation is in many cases not yet forthcoming, but the importance of the observations is obvious.

The velocity and limit of a reaction is determined by the nature of the substances, their relative masses, the concentration of the solutions, the temperature, and in some cases, the pressure and other conditions. If we take, as an example, the reaction between ordinary alum and hypo, which takes place in accordance with the following equation: K_2SO_4, $Al_2 3SO_4 + 3Na_2S_2O_3 + 3H_2O = K_2SO_4 + 3Na_2SO_4 + 3SO_2 + S_3 + Al_2(OH)_6$. We find that if we mix the two solutions and heat them, the formation of a precipitate takes place more rapidly and more abundantly than if we allow them to remain at the ordinary temperature. If we mix equal volumes of five per cent. solutions of the two salts, and equal volumes of ten per cent. solutions, the formation of a precipitate is more rapid in the second case. Direct experiment shows, however, that the limit of this particular reaction is always the same, and if sufficient time is given, either the alum or the hypo is completely decomposed.

In most cases it is found that the velocity of a chemical change is at first very small, but increases rapidly and attains a maximum, then decreases very gradually as the reaction approaches completion.

We are compelled ultimately to attribute chemical combination and all chemical changes to the existence of some force of the nature of attraction, which is exerted in different degrees between the atoms of the different elements, and to which we give the name *chemical affinity*. The older chemists drew up tables of affinity, which were supposed to show the relative attractions of substances for one another, and the order in which they can displace one another from compounds. It was, however, soon recognized that the relative affinities vary with the conditions, and so early as 1775 Bergmann constructed different tables of affinity for high and low temperatures. The following small table, for example, shows the relative affinities of the different acids for potash, dependent upon whether the reaction takes place in solution at comparatively low temperatures, or between the solid substances at a high temperature.*

In solution : low temperature.	*Solid ; high temperature.*
Sulphuric acid.	Phosphoric acid.
Nitric acid.	Boric acid.
Hydrochloric acid.	Arsenic acid.
Phosphoric acid.	Sulphuric acid.
Arsenic acid.	Nitric acid.
Acetic acid.	Hydrochloric acid.

* Muir, " Principles of Chemistry," p. 402.

Later attempts were made to represent affinities by numbers, and it was laid down as a general principle that the sum of the affinities of the products of a reaction is always greater than the sum of the affinities of the original substances.

Our present knowledge teaches us that it is extremely difficult to draw up tables of affinities which shall be really useful, and hold good through any considerable range of conditions. Moreover, we have learnt that in discussing any given chemical change it is not permissible to follow the example of the older chemists and confine our attention to one or two products. Every one of the original substances and every one of the products, be its proportion ever so small, must be taken into careful consideration. Take as an example the relative affinities of the haloid elements, chlorine, bromine, and iodine, for silver, a question which has for us a special interest. If we add a solution of silver nitrate to a solution containing potassium iodide, bromide, and chloride in about equal proportions, we find that the precipitate at first consists of silver iodide. When all the iodide has been precipitated, silver bromide begins to form; but it is not until all the bromine is thrown down that any considerble amount of silver chloride is formed. From this result we should write, in the order of their affinity for silver, iodine, bromine, chlorine. If, however, we take silver iodine and bring it in contact with bromine, silver bromide is formed, and iodine is liberated; and if silver bromide in its turn is brought in contact with chlorine, bromine is expelled, and silver chloride is formed. From these results the order of affinity would be completely reversed—chlorine, bromine, iodine.

Now, it has been established by innumerable experiments that the quantity of energy in the form of heat liberated by the formation of a given compound under a given set of conditions is a constant quantity, which is known as the *heat of formation* of the compound. Further, the work which has to be done—*i. e.*, the quantity of energy in the form of heat, electricity, or radiant energy which is required to decompose a compound, is exactly equivalent to its heat of formation. It follows that compounds with the greatest heats of formation are the most difficult to decompose, and hence the heats of formation may be taken as measures of the strength of the attraction which the atoms have for one another, or, in other words, as a measure of their chemical affinities. It is also found that when substances which can react in different ways are brought together, there is a tendency to the occurrence of that particular reaction which liberates the greatest quantity of heat. This, in fact, is only a special case of the principle of the dissipation of energy, according to which the energy of the material universe, whilst remaining constant in amount, tends to pass into the form of heat and become evenly distributed. Quantities of heat are expressed in thermal units or calories, a *major calorie* being the quantity of heat required to raise the temperature of a kilogram of water by 1° C., and a *minor calorie* the quantity required to raise the temperature of a gramme of water 1° C. The action of the haloid salts of potassium on silver nitrate, all the substances being in solution, liberates the following quantities of heat:

$AgNO_3$ diss. + KI diss.=AgI ppt. + KNO_3 diss. 26,440 cals.
$AgNO_3$ diss. + KBr diss.=AgBr ppt. + KNO_3 diss. 20,130 "
$AgNO_3$ diss. + KCl diss.=AgCl ppt. + KNO_3 diss. 15,870 "

The formation of the iodide in this way liberates more heat than the formation of the bromide; that of the bromide liberates more heat than that of the chloride.

In accordance with the principle just stated, the tendency to form silver iodide should be greatest, and the tendency to form the chloride least, and this we have seen to be actually the case.

The heat liberated by the formation of each of the three compounds *from its elements* is found to be as follows:

Silver iodide.	Silver bromide.	Silver chloride.
13,800 cals.	22,700 cals.	29,380 cals.

and since the heat liberated or absorbed in the conversion of one compound into another is the difference between their heats of formation, it is easy from these data to deduce

$$\underset{13,800}{AgI} + Br = \underset{22,700}{AgBr} + I \text{ liberates } 8,900 \text{ cals.}$$
$$\underset{22,700}{AgBr} + Cl = \underset{29,380}{AgCl} + Br \text{ liberates } 6,680 \text{ cals.}$$

8,900 cals. and 6,680 cals. being the differences between the heats of formation of the iodide and bromide, and the bromide and chloride respectively. Here then we have the explanation of the second set of decompositions. How can we reconcile the two? Returning to the first set of changes, we find that we are dealing not only with the decomposition of a silver compound, but also with the decomposition of potassium compounds. Silver nitrate becomes silver iodide, bromide, or chloride; but potassium iodide, bromide, or chloride at the same time becomes potassium nitrate. The heats of formation of these salts are found experimentally to be as follows:

Silver nitrate.	Potassium nitrate.	Potassium chloride.	Potassium bromide.	Potassium. iodide.
23,300	110,960	101,170	90,230	75,020 cals.

Now, if we compare these numbers with those obtained previously we find tha

$$AgNO_3 \text{ into } AgI = 13,800 - 23,300 = \text{absorbs } 9,500 \text{ cals.}$$
$$AgNO_3 \text{ " } AgBr = 22,700 - 23,300 = \text{absorbs } 600 \text{ "}$$
$$AgNO_3 \text{ " } AgCl = 29,380 - 23,300 = \text{liberates } 6,080 \text{ "}$$

but

$$KI \text{ into } KNO_3 = 110,960 - 75,020 = \text{liberates } 35,940 \text{ cals.}$$
$$KBr \text{ " } KNO_3 = 110,960 - 90,230 = \text{liberates } 20,730 \text{ "}$$
$$KCl \text{ " } KNO_3 = 110,960 - 101,170 = \text{liberates } 9,790 \text{ "}$$

That is to say,—

(1) The conversion of silver nitrate into the iodide absorbs 9,500 cals., but the conversion of potassium iodide into the nitrate liberates 35,940 cals.; giving a balance in favor of the reaction of 26,440 cals.

(2) The conversion of silver nitrate into the bromide absorbs 600 cals., but the conversion of potassium bromide into the nitrate liberates 20,730 cals.; giving a balance in favor of the reaction of 20,130 cals.

(3) The conversion of silver nitrate into the chloride liberates 6,080 cals., but the conversion of potassium chloride into the nitrate liberates only 9,790 cals., so that the total balance in favor of the reaction is only 15,870 cals.

In these cases it is evident that the direction of the reaction is determined by the circumstance that the heat disturbances accompanying the changes of the potassium

salts are very much greater than those which accompany the changes of the silver salts in the opposite directions. Practically the same results are obtained with ammonium or sodium salts in the place of those of potassium, and we have here a very striking instance of the importance of taking all the reacting bodies into consideration.

When silver chloride is treated with a solution of potassium bromide, it is converted into silver bromide, potassium chloride being formed at the same time; and if silver bromide is treated with potassium iodide, silver iodide and potassium bromide are formed. Using the same data as before:

AgCl + KBr =		AgBr + KCl		
29,380	90,230	22,700	101,170	liberates 4,260 cals.
AgBr + KI =		AgI + K Br		
22,700	75,020	13,800	90,230	liberates 6,310 cals.

The heat liberated by the conversion of potassium bromide into the chloride is greater than that absorbed by the conversion of silver chloride into the bromide; and the heat liberated by the conversion of potassium iodide into the bromide is greater than that absorbed by the conversion of silver bromide into the iodide. In the case of silver chloride and potassium iodide the balance in favor of interaction is still greater.

A different but very instructive example of the necessity of taking all the substances present into consideration is afforded by the reaction between chromium compounds and hydrogen peroxide. It is well known that if hydrogen peroxide is added to an acidified solution of potassium bichromate, a deep blue compound is formed, but this rapidly decomposes, with evolution of oxygen, and the color of the liquid changes from orange to green because the chromate is reduced to the condition of a chromic salt. Thus: $K_2Cr_2O_7+8HCl+3H_2O_2=Cr_2Cl_6+2KCl+7H_2O=3O_2$.

If, on the other hand, hydrogen peroxide is added to a solution of chromic oxide in caustic potash or caustic soda, the liquid becomes yellow owing to the oxidation of the chromic oxide and formation of a chromate. Thus:

$$Cr_2O_3+4KHO+3H_2O_2=2K_2CrO_4+5H_2O.$$

That is to say, in presence of an acid, hydrogen peroxide reduces chromates to chromic salts, whilst in presence of an alkali it oxidizes chromic salts to chromates. Direct measurements show that the first reaction liberates a considerable quantity of heat, due mainly to the formation of the chromic chloride and the liberation of oxygen, whilst the second reaction also liberates heat, owing to the formation of the potassium chromate.*

We see from these examples that the quantity of heat absorbed or liberated plays a very important part in determining the course of a chemical reaction, this quantity being the algebraic sum, or resultant, so to speak, of several subsidiary combinations and decompositions, some operating in one direction, some in another.

In the case of the haloid silver and potassium compounds, which we have already discussed, it is found that if the substances interact at the ordinary temperature, and in equal molecular proportions, the conversion of the silver chloride into bromide is never quite complete, only about 95 per cent. of the theoretical quan-

* Berthelot, *Comptes Rendus*, 108, 24.

tity of silver bromide being formed, whilst the rest of the silver remains as chloride. The same result is obtained when silver nitrate (one molecule) is added to a mixture of potassium chloride and bromide in equal molecular proportions.* Further, if silver bromide is treated with a large quantity of potassium chloride, a certain proportion is converted into silver chloride.

We come here to the influence exerted on the course and limit of a chemical reaction by the relative masses of the reacting substances. In 1803 Berthollet endeavored to show in his *Essai de Statique Chimique* that the amount of a chemical change is conditioned by the relative masses of the reacting bodies and their coefficients of affinity, but as he did not recognize the laws of combination in definite proportions by weight, his views did not meet with general acceptance. Since that time, however, the influence of mass has been investigated mathematically and experimentally by Guldberg and Waage, Ostwald, Potilitzin, and others, and a summary of the most important results can be found in Muir's *Principles of Chemistry* or the English translation of Lothar Meyer's *Modern Theories of Chemistry*. This influence is most strongly marked in the case of reversible reactions, *i. e.*, those which under suitable conditions work more or less completely in both directions. One of the best-known examples of a reaction of this kind is the decomposition of a solution of bismuth chloride by water, with production of a precipitate of bismuth oxychloride, hydrochloric acid being also formed and remaining in the liquid, thus: (A) $BiCl_3 + xH_2O = BiOCl + 2HCl + x - IH_2O$. On the other hand, if bismuth oxychloride is treated with hydrochloric acid, it redissolves with formation of bismuth chloride and water, thus: (B), $BiOCl + y\,HCl = BiCl_3 + H_2O + y - 2HCl$. The reaction is completely reversible, and the direction in which it takes place is determined by the relative masses of bismuth chloride, water, and hydrochloric acid.

In all cases where a reaction is reversible we are really dealing with the relation between two velocities. The configuration of the system we are considering, consisting as it does of bismuth, oxygen, chlorine, and hydrogen, is dependent upon the relation between the velocity of reaction A and the velocity of reaction B. If the velocity of A is the greater, *i. e.*, if the conditions are such that more molecules of bismuth chloride are converted into oxychloride in a given time than can be reconverted into the chloride, then precipitation of the bismuth oxychloride will take place, and will continue until, in consequence of the removal of bismuth chloride, and the increase in the amount of hydrochloric acid, the velocity of the two reactions becomes equal, and equilibrium is established. When, on the other hand, the conditions are such that the velocity of B is greater than that of A, then more bismuth oxychloride can be reconverted into chloride in a given time than can be formed in that time; hence there is no precipitation, and the system remains in equilibrium.

We regard matter as consisting of very minute particles which we call molecules, and which, in liquids and gases, are in a state of continual motion from place to place, and are therefore continually coming into encounter with one another. It does not follow that molecules of different kinds will interact every time they encounter one another, but it is obvious that, other things being equal, the greater the number of encounters the greater the chance of a reaction taking place. We should expect therefore, in the case we are considering, that if we increase the mass

* Potilitzin, *Ber. d. Deutsch. Chem. Ges.*, 1883, p. 3,053.

of water present, and thus increase the number of collisions between molecules of water and molecules of bismuth chloride, we should increase the velocity of reaction A, or, in other words, increase the tendency to form a precipitate. If, on the other hand, we increase the mass of hydrochloric acid present, we increase the velocity of reaction B, and reduce the tendency to precipitation. It is obvious that the greater the proportion of acid present the greater will be the quantity of water required to produce a precipitate, *i. e.*, to make the reaction work in the direction A. The reaction has been very fully investigated,* and it is found that the mass of water required to produce a precipitate is very large compared with the mass of hydrochloric acid present. The velocity of B, by reason of the affinities of the elements concerned, is much greater, under normal conditions, than the velocity of A, and it is only when the mass of water becomes relatively very large that the velocity of A is increased sufficiently to make it exceed that of B.

In the case of the action of potassium bromide on silver chloride, and of potassium chloride on silver bromide, there is even a greater difference in the velocities, that of the first reaction $KBr + AgCl = AgBr$ being very much greater than that of the second, $AgBr + KCl = AgCl + KBr$. In order to completely decompose the silver bromide the mass of potassium chloride would have to be very large indeed, whereas a comparatively small excess of potassium bromide is sufficient to make the first reaction complete, and convert the whole of the silver into bromide.†

Causes which are commonly regarded as purely physical may exert a great influence on the velocity of a chemical reaction, although as a rule they have little influence on the limit if sufficient time is allowed for equilibrium to be established. It is well known, for instance, that vigorous agitation of a liquid, or rubbing the sides of the vessel with a glass rod, will promote the formation of a precipitate. It is also found that precipitation of many compounds is accelerated by the presence of broken glass and similar substances. Admixture with viscous bodies such as gelatine, glycerol, etc., even when they do not act upon the individual substances, frequently retards a chemical reaction in a very marked manner, although if sufficient time is given the same result is obtained in the end as if the gelatine, etc., had not been there. Muir has shown (*loc. cit.*) that the way in which the bismuth chloride solution and water are mixed may exert very great influence upon the rate at which the decomposition takes place, without affecting the limit at which equilibrium is established. A bismuth chloride solution of the proper strength can be mixed gradually with a certain amount of water, and precipitation will not begin until after some time, but if the same quantity of water is carefully poured upon the same quantity of bismuth solution, so that the two liquids form distinct layers, and then by agitation they are mixed suddenly, precipitation begins immediately, and at first proceeds rapidly, but afterwards the change becomes very slow. In both cases the same limit is reached in the end.

It has not been possible in all cases to illustrate the different points by examples of specially photographic interest. My aim has been to give a general idea of the various problems which the investigation of a chemical change presents. In conclusion, it may be useful to discuss from this point of view one of the most important,

* M. M. P. Muir, *Journal of the Chemical Society*, 1879, 311.

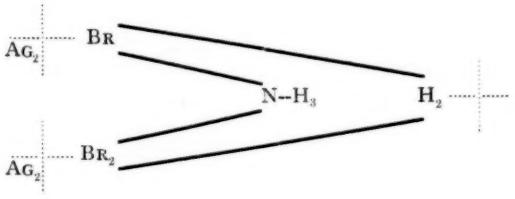
† For other examples, see *Journal of the Chemical Society*, 1878, 27; 1880, 60 and 424.

if not the most important, of photographic processes—development by means of alkaline pyro. The initial and final configurations of the system may be presented in this way:

Initial Configuration.	*Final Configuration.*
$x\ Ag_2Br$	$x+y\ Ag_2$
$y\ Ag_2Br_2$	$x+2y\ NH_4Br$
$z\ NH_3$	$z-(x+2y)\ NH_3$
$m\ H_2O$	$m-\left(\frac{x}{2}+y\right) H_2O$
$n\ C_6H_3(OH)_3$	$n\ C_6H_3(OH)_3+\left(\frac{x}{2}+y\right) O$
$\overline{}\ pNH_4Br$	$\overline{}\ pNH_4Br$

Here the original substances, neglecting all unnecessary complications, are silver sub-bromide, silver bromide, pyrogallol, water, ammonia, and ammonium bromide, though this last is not absolutely necessary. The products are metallic silver, oxidized pyrogallol, an increased amount of ammonium bromide, and a reduced amount of ammonia and of water.

We start with a certain number of molecules of silver bromide and sub-bromide, of ammonia, water, and pyro; we finish with reduced metallic silver, an increased amount of ammonium bromide, a smaller amount of ammonia and of water, and oxidised pyro.* The main chemical attractions which come into play may be represented in this way;

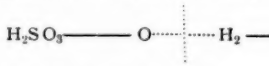


The horizontal broken lines represent the attractions which tend to keep the system in its initial condition; the unbroken lines represent the attractions which tend to bring about a new arrangement of the atoms; the vertical broken lines indicate the points at which ruptures of the existing molecules in all probability take place. It is interesting to observe that the action, as thus represented, is strictly analogous to

* I assume the existence of silver sub-bromide Ag_2Br and the truth of the theory of development which is generally formulated. I am not, however, contending for the truth of either of these assumptions, but simply wish to illustrate one method of looking at the phenomena.

the well-known reaction between another reducing agent, sulphurous acid, and many coloring matters:

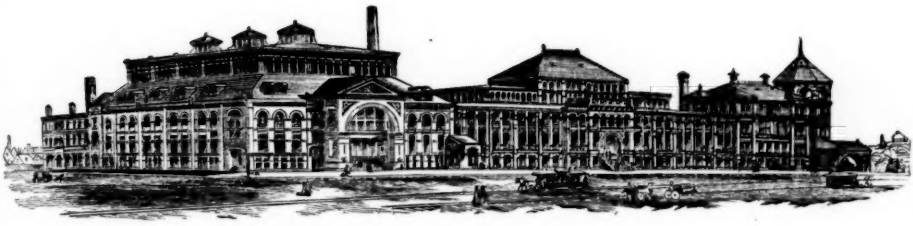
$$H_2SO_3+OH_2+dye=H_2SO_4+(dye+H_2)$$



The reactions which take place during the development are complicated almost from the beginning by the introduction of an electrolytic action between the silver bromide and the metallic silver, which, as Abney has shown, plays a very important part in the building up of the deposit of silver.

Now, what a photographer is most concerned with is the rate at which development takes place; or, in other words, with the velocity of the reaction. This velocity depends in the first place, other things being equal, upon the concentration of the developer. Every photographer knows that a strong developer acts more rapidly than a weak one. It depends also upon upon the temperature: if the latter is low, density is obtained very slowly, but if the liquid is warmed to an average summer temperature a great increase in the rate of development is at once observed. The velocity depends also upon the relative masses of ammonia, pyro, and ammonium bromide present at the beginning, and, on the whole, shows the same kind of variation as in ordinary chemical changes, *i.e.*, it is very small at the beginning, then rapidly increases, and finally becomes smaller and smaller until the change ceases altogether. Looking at the diagrams of configurations and strains it is easy to understand why the rate of development should increase with an increased amount of ammonia or of pyro, since these are the active agents in reducing the silver bromide; and it is also easy to see that the rate of the reaction will gradually diminish, because as it proceeds the amounts of ammonia and pyro become reduced, the former being converted into ammonium bromide and the latter being oxidised. The influence of the ammonium bromide, which is introduced as a retarder, is by no means clear. It may be that we have here something of the nature of a reverse reaction, or that we are dealing with a phenomenon akin to evaporation, the tendency towards the formation of fresh ammonium bromide being reduced when the amount already present in the solution is increased, just as the tendency of a liquid to evaporate is reduced as the amount of its vapor in the surrounding atmosphere is increased. Assuming that the ordinary theory is correct, any cause which checks the formation of fresh ammonium bromide will of course check the reduction of the silver bromide or sub-bromide. This, however, is one of the points which still require investigation, as indeed does the whole process. May I, in conclusion, be allowed to point out that the only method of investigation which can yield results of any value in these and all similar cases is the method of painstaking and accurate experiment?

C. H. BOTHAMLEY, F.I.C., F.C.S.



TENTH ANNUAL CONVENTION.

Editor of AMERICAN JOURNAL OF PHOTOGRAPHY:

THERE is no longer a doubt but that the "Grand Semi-Centennial Celebration of Photography," held under the auspices of the Photographers' Association of America, will be a success. Encouraging news from every quarter indicates that the largest gathering of the photographers' fraternity that has ever been known will assemble in Boston on the sixth of next August.

We have been credibly informed that there has been a great deal of silent preparation being made to capture some of the "Semi-Centennial Awards." Everything tends to show that the contest will be sharp and spirited, more especially for the "Grand Award," which will be not only valuable intrinsically, but bring a small fortune to the lucky man.

In addition to the grand display of art photographs which are to enter for competition this year, we are promised rare specimens that have won prizes during the life of the P. A. of A., as well as a number of collections of the most celebrated pictures made during the last half century.

In the photographic merchants' department the space has never been taken so rapidly or in such large quantities. A letter from Secretary Scott informs me that all the thirty thousand square feet on the main floor have been taken, and we are obliged to put a number on the second floor.

The great manufacturing establishments of Scovill & Adams Co., and E. & H. T. Anthony & Co., of New York, and the Blair Camera Co., ofBoston, have informed us that they have been making extensive preparations for the past year to have the grandest and most complete display of photographic apparatus ever put on the market.

Eastman Dry Plate and Film Co. says, "Tell the photographers that we will make a larger exhibit than ever before, and our awards more costly and greater in number than at any previous convention.

G. W. Entrekin, of burnisher fame, tells us that he is going to ship burnishers to Boston by the ton, that will show all the latest improvements.

The well-known house of Smith & Patterson, Chicago, have taken nearly twelve hundred square feet, and "Tom" Patterson says they are going to ship most of their store down to Boston, including their burnisher.

L. W. Seavey has built a new studio, that he might be able to get out the great amount and variety of backgrounds and accessories that he intends to exhibit.

The Stanley & Harvard Dry Plate Co. tell us they will shortly announce some elegant prizes for the best collection of photographs on their respective plates.

The Acme Burnisher Co., of Syracuse, N. Y., say they will soon make known something new and startling in the way of an award for the best collection of Art-Photographs at the Boston Convention.

A letter from Mr. Althouse, Manager of Cramer's Dry Plate Works, says that Mr. Cramer will return about the first of June, and will be on hand to make a grand display and help celebrate.

These are only a few of the good things that are promised for the photographers who attend the convention, and others will be announced as soon as we are informed.

Geo. H. Hastings, first vice-president, says that Codman & Co., Benj. French & Co., and the Blair Camera Co., will unite with the photographers of Boston to do all in their power to make the Tenth Annual Convention a complete success.

A letter from Tiffany & Co., of New York, says that the silver badges for members will be in the hands of the Treasurer about the first of June, and I would advise all of those members who want to attend the opening ceremonies on the morning of August 6th to send in their dues, and Treasurer Carlisle will send them a badge and receipt. This will avoid the great rush on the opening day.

I would also announce that the headquarters of the Executive Committee will be Tremont House. Rates, $2.50 and $3 per day; $4 including bath. Many of the older members of the Association will recognize in the proprietor, Mr. Harris, their former host at the Buffalo Convention, when they made the "Genesee" their headquarters. Mr. Harris promises to do everything in his power to make our visit to Boston a pleasant one.

Very truly yours,

H. McDONALD,

P. S.—I send you cut of Hall in Boston where the Convention is to be held.

H. McD.

PHOTOGRAPHY APPLIED TO MILITARY PURPOSES.

IT was with some diffidence that I accepted the invitation to read a paper at this conference. I have not as yet had much opportunity of studying the subject of photography applied to military purposes. In fact, the useful and practical applications which have hitherto been made are but few in number, although many writers are of opinion that there is a wide field for progress in this direction. It may be well also to add that no new scientific principle is involved in anything which can be said on the subject.

The equipment for active service consists of a wagon (of which I pass round a photograph for your inspection) fitted up as a dark room. There are two cameras, one to take picture 12-in. x 10-in., and one 7½-in. x 5-in. The latter is so arranged that it can be carried on a pack horse or mule with lenses, plates, etc., in country where the wagon could not be taken. Development and printing must, however, be done in the wagon itself.

A battery of six lenses (one wide angle, one rapid rectilinear, and one single view for each camera) forms part of the equipment, and the chemicals, etc., supplied

in the first instance are sufficient for preparing some scores of negatives and some hundreds of prints.

The printing process used is the hot bath platinotype, but in all probability this will shortly be superseded by the cold bath process. Bromide paper is also taken to meet those cases in which proofs are required in great haste or at night.

Gelatine dry plates of various makes are used at present, and here again a change may perhaps with advantage be introduced. It is said that the stripping films have been found preferable in some foreign countries; the saving in weight effected by their use would certainly be a great consideration.

The photographic wagon is attached to the headquarter staff of the army corps. It would be in charge of an officer who might be called on to photograph fortifications, bridges, safes, entrenchments, etc., as required. He would be called upon, perhaps, quite as frequently to copy, enlarge, or reduce plans, reconnoissances, etc., of which a limited number are required for distribution.

In both the Abyssinian and Souakin campaigns a large number of photographs were taken of camps, the country generally, troops on parade, zareebas, prisoners of war, and other subjects. These were useful for illustrating reports; still they are semi-official rather than official.

Permission was granted, after each campaign, that officers wishing for prints of any of the views, might obtain them on repayment. The large number sold proves the interest taken in the series.

The bromide process has been found very useful for work of this kind. I pass round an example for inspection. The blue process might be useful.

Photography may also be employed in connection with the field lithographic wagon for the reproduction of plans, sketches, etc., in greater numbers than could be rapidly executed by any purely photographic process.

The lithographic wagon is equipped for working Captain Abney's papyrotype process and Husband's papyrotint or half-tone process.

The plan to be copied is fastened to the side of the wagon, and the camera supported on a stand provided for the purpose (as shown in one of the photographs.)

The complement of non-commissioned officers and men are six. These would be selected from among those who have been trained at the School of Military Engineering at Chatham.

The principal use to which photography is put in peace time is for the photo-mechanical reproduction of plans and maps. This is principally done by the wet plate process, especially for line work. For such purposes the lines of the negative must be almost absolutely clear, and this condition is far more easily fulfilled in wet than in dry plates. The greater part of the work executed at the school at Chatham is of this kind, and does not differ from that done by various commercial firms in London and elsewhere. Although such work is not directly useful for active operations in the field, it is valuable as a training for the N.C.O.'s, and men employed on it. Also, when photo-mechanical work has to be done in great haste for some official purpose, there is no comparison between the cost of doing it by military labor, and giving it to a firm to execute. For instance, a part of General Gordon's diary was reproduced in fac-simile at Chatham for the House of Parliament, 140 negatives and 25 sets of photo-lithographs being taken and completed in seven days.

Photography is largely used at the headquarters of the Ordnance Survey at Southampton for the reproduction of maps. The maps are drawn in the field to a scale of 25 in. to a mile, and published of that size. For the smaller edition of 6 in. to a mile, each map is re-drawn on the scale of 25 in., with the names shown of an exaggerated size. This drawing is reduced by photography to the scale of 6 in. to a mile, with the result that the names and details come out in proportion. From the negative so prepared, photo-zincographs are printed for publication and sale.

A further reduction to the scale of 1 in. to a mile is then necessary. For this purpose a blue print is taken from the 6-in. negative, and on it are shown in black such details as are required for the smaller scale. It is, of course, impossible to show all that is included in the 6-in. maps. The reduction is effected by photography, and reproduces only those portions which have been drawn in black ink, excluding those which are in blue. A transfer is made on a film of chromated gelatine, and laid down on copper. The copper plate is engraved with all the necessary detail and impressions taken from it as required.

This leads us to the consideration of photography as employed for the preparation of original surveys. It has often been suggested that the theodolite and the level should be replaced by a camera, and there is no apparent reason why this should be difficult. A base is measured in the usual way, and at each extremity views are taken all round the horizon. The camera is carefully leveled for the purpose.

By a simple mechanical arrangement in the body of the camera the true horizon is drawn across the negative, and also the vertical line which represents the vertical plane containing the axis of the lens. The focal length of the lens is known, and by the application of the principles of plane perspective we can calculate or construct the horizontal angle between any two points in the view. This is what would be given by a theodolite, so that the country may be plotted in the usual way. A further calculation or construction will similarly give the vertical height of any point above or below the datum level.

Similar rounds of photographs must be taken from other suitable positions: by this method a very large number of points may be fixed with considerable accuracy throughout the survey.

It is claimed by the advocates of this system (of which a full description is given by Lieut. Reed of the U. S. Army in his book on "Photography applied to Surveying"), that the field work is much shortened; that there is no risk of topographical features being omitted; and that photographs give valuable additional information with regard to the country. It seems, therefore, specially applicable for military purposes, such as surveying an enemy's position, or the road followed by troops on the march.

Several forms of apparatus have been devised for preparing photographs specially for this purpose. The cylindrograph of M. Moëssard is a camera of semi-circular form, having a lens at the centre. The sensitive film is placed inside the circular portion at a distance from the lens equal to its focal length. By rotating the lens a cylindric perspective view of about 170° of the horizon is obtained.

Apparatus have also been devised by M. Chevalier and M. Mangin for obtaining radial perspective views round a given point.

It is stated that satisfactory results have been obtained in France and in America

in the experiments made in photographic surveying. The attempts made in this country have, as far as I can ascertain, invariably been failures. The weather is so often unfavorable for taking views, especially views of distant objects, that it is difficult to recognize the same point in different photographs. If the sun should happen to be shining, it is impossible to work with the camera facing towards it, so that the method seems quite inapplicable for a country like this. The further disadvantages that a large amount of equipment is required, and also considerable skill on the part of the operators, render it very unlikely that it will be useful to an army in the field.

Balloon photography, on the other hand, seems likely to become of more importance. As long ago as 1862 the Union army before Richmond succeeded in taking a view of the enemy's position. Two prints were made, one being retained by the aëronaut. Rectangles corresponding in number and disposition were ruled on each, and marked with reference numbers. During subsequent ascents the aëronaut was able to signal the movements of the army and all important events which occurred in any rectangle. This information was found to be of great value.

It may be expected that balloon photography will be found of great use to a besieging army. A small balloon, capable of carrying a camera loaded with a number of plates, may be started from the windward side of the besieged town. No aëronaut is employed, but by a clockwork arrangement the plates can be exposed in succession at any desired interval after the balloon starts. The gas gradually escapes from a valve in the balloon, or the valve may be released by clockwork after a certain time, and the camera descends in or outside the besiegers' lines on the leeward side of the town.

It is obvious that all this is not easy to carry out. The wind may be troublesome, or the clockwork fail at the critical point; the balloon may ascend too high or descend too low, and so on. But this is, at any rate, one direction in which military photography will, no doubt, be developed.

Another suggestion for taking a series of views of a besieged fortress is, that a number of balloons should be released to windward, each carrying a camera, and attached by a cord to the one before it. The last balloon has a hole cut at the top, or a valve opened, so that it may descend after a certain time on the other side of the fortress, and enable the others to be recovered. Photographs would be taken from each balloon during the passage over the enemy's position.

A good account of the most recent experiments in balloon-photography is given in M. Tissandier's work "La Photographie en Ballon."

I have referred more especially to the use of free balloons. It is certain, however, that captive balloons may, at times, be very useful. The difficulty with these is that they oscillate so rapidly, especially when the wind is high. Also the cord by which the balloon is held is liable to obstruct the view when the apparatus is worked automatically. It is possible that a kite might be used instead of a captive balloon, or perhaps a series of kites which would tend to steady each other. It would be quite easy to raise a small camera, but it would be difficult to point it in any required direction: and the method has not yet been proved to have any practical value.

Mr. Arthur Batut claims to have obtained satisfactory negatives in this way. Mr. Archibald Douglas has also published a pamphlet on military kites.

Both in photography from a kite and from a captive balloon, electricity may be employed for releasing the shutters at any required moment.

With regard to the risk of a balloon being damaged by the enemy's fire, it appears, from experiments carried out at Tours, that a balloon is safe even from artillery fire at a height of 600 or 700 yards. At a much lower level it would have a good chance of escaping. Little is known of the trajectories of bullets or cannon balls at very high angles of elevation, so that ordinary sights are not of much use. Also, it is impossible to see whether the shot passes too high, or too low, or to one side, and so correct the aim, as can be done when firing at an object on the ground. In addition to this, even if the balloon is hit by one or two bullets, the escape of gas would be slow, so that there would be a good chance of its being saved. For these various reasons, the danger to which a balloon is exposed from hostile fire is not nearly as great as might be expected.

Photography has recently been used for obtaining views of a rifle bullet in flight.

The rifle is so arranged that the bullet shall pass in front of a camera placed in a dark room. Before reaching the dark room it completes an electric circuit, and causes a spark to pass between terminations connected with the two coatings of a Leyden jar.

The arrangement is such that the spark passes at the instant the bullet is in front of the lens. A sheet of white paper is placed so that the bullet may be clearly shown against the white background. This method is stated to have been worked with success both in America and in Germany. The use of the electric spark as an illuminant renders an instantaneous shutter unnecessary. The bullet is seen to be surrounded by curves, those in front being approximately hyperbolic, and those at the sides rectilinear. Behind the bullet are seen eddies. These curves are similar to the waves and eddies produced by a vessel moving through the water, or those produced by the piers of a bridge over a river flowing with considerable velocity.

It can be shown mathematically that these curves (which represent in reality waves of sound) can only be produced when the velocity of the bullet exceeds that of sound; and, in fact, the photographs of bullets moving with a lower velocity show no such curves.

The practical application of these experiments is, perhaps, not obvious. They are certain, however, to lead to a better understanding of the laws governing the resistance met with by a projectile in its flight, and will assist in the selection of such forms and sizes for projectiles of all kinds as will reduce friction to a minimum, and give the best and most accurate trajectory.

Herr Anschütz has succeeded in photographing a cannon-ball in somewhat the same manner. Daylight was used, and therefore an instantaneous shutter released by the projectile was necessary. It was found that it took 0.28 of a second for the shutter to move. During this period the projectile moved 113 metres, so that by allowing a distance of 113 metres between the camera and the point at which the electric circuit was completed, the exposure was made just when the projectile was passing between the camera and a white background arranged for the purpose. The length of exposure was 76 millionths of a second.

Herr Anschütz only succeeded in obtaining one good photograph in a number of trials, but he hopes to be able to reduce the process to a certainty. It would be

interesting to know what kind of shutter he used, and how he measured the length of exposure, but no details as to these points are given in the paper from which I have taken this description.

Photography is constantly employed to record the results of experiments with ordnance of all kinds and with explosives.

The effect of shot and shell on earthworks, armor-plating, etc., is tried almost every year in England and elsewhere, and it is very useful to have a permanent and accurate record of the effect of each shot. In the explosion of submarine mines it is interesting to be able to take a series of views at different periods of the explosion. The Americans have taken some most successful photographs of this kind at their military school at Willett's Point.

We have tried similar experiments at Chatham during the last month. I pass round some of our results.

The apparatus used is one devised by a brother officer of mine, and is most ingenious in its construction. Six photographs can be taken within about three seconds and a half after the explosion. Unfortunately, all our photographs were more or less fogged, owing to a defect in the apparatus, which requires to be altered in several of its details. However, as this is the first time that it has been used, one can hardly as yet expect thoroughly good results.

The time was registered electrically on an apparatus similar in principle to a Morse recorder, or to that used in an observatory for recording the passage of stars.

Photographs are used by military engineers (as also civil engineers) for recording the progress of works in course of construction at foreign stations, and for illustrating reports. It is a rule of the War Department that all prints shall be executed in some permanent process. Silver prints are, therefore, inadmissible. Until a few years ago the carbon process was used. This has now been superseded by platinotype.

It will be remembered that photographic despatches were borne by carrier pigeons from Paris during the siege in 1871.

All despatches were printed on a large sheet, which could contain about 300,000 letters. This was reduced to a negative about 2 in. by 1 in., and printed on a film of collodion. A pigeon could carry twenty of these films rolled up in a quill, the whole not weighing more than 15 grains, and including some two or three million letters, or say the equivalent of sixty ordinary newspapers.

On arriving at their destination the films were placed in very dilute ammonia so as to unroll themselves. They were then dried, placed between plates of glass and enlarged with the photo-electric microscope.

Photography has been used for illustrating various mechanical manœuvres, such as infantry and cavalry drill, or the arrangement of blocks and tackle for moving guns. Also for placing on record details of dress and accoutrements, with the methods of keeping the same in the barrack-room and laying them out for inspection.

The camera might possibly be of use for estimating the distance to a parapet or other object of which the length is known.

The length of the image on the ground glass, the focal length of the lens, and the length of the object will give the distance required.

Another subsidiary use of photography is for taking the portraits of men dismissed from the army as worthless and incorrigible, and those who have deserted

once and may be expected to do so again. Such portraits would of course be of use if it were required to identify the men at any future time.

This has never been done in England, but I believe that on the Continent photography has been used for this purpose.

In concluding this paper I will only add that I should be very glad if any member of the audience would suggest any application of photography to military purposes which may occur to him other than those enumerated. I cannot hope to have exhausted all the ways in which photography has been or might be utilized.

CAPTAIN A. M. MANTELL, R. E.

THE PHOTOGRAPHIC SOCIETY OF PHILADELPHIA.

A STATED Meeting of the Society was held Wednesday evening, June 5, 1889, with the President, Frederic Graff, in the Chair.

The Secretary reported the death of Mr. Charles F. Butler, a member of the Society, who was lost in the disastrous flood at Johnstown, Pa., on May 31st. Mr. Butler held the position of Assistant Treasurer in the Cambria Iron Co., having removed his residence from Philadelphia to Johnstown within a recent period.

The Excursion Committee through its Chairman, Mr. Samuel Sartain, made a report suggesting a series of three one-day excursions on Saturdays, June 15th, 22d, and 29th, probably to different points on Brandywine Creek, Penna. On motion of Mr. Rosengarten the Committee was authorized to arrange and carry out all details of such a programme as proposed above.

The Committee on Joint Exhibition presented the following report:

"The Third Annual Joint Exhibition of the Society of Amateur Photographers of New York, The Photographic Society of Philadelphia, and the Boston Camera Club, was held in the Galleries of the Pennsylvania Academy of the Fine Arts, Philadelphia, April 8 to 20, 1889, under terms of agreement and rules adopted at a meeting of representatives from the three Societies held in New York, Oct. 22, 1886, revised and amended Nov. 10, 1888.

"By the revised and amended rules definite regulations were adopted for holding and governing such meetings of the Joint Exhibition Council as may be deemed necessary.

"All entry of exhibits by classification was abolished, and the awarding of diplomas by classification was limited to the seven diplomas for "special excellence" reserved for the recognition of exceptional merit in certain principal lines of photographic work, one diploma being placed at the disposal of the Judges for each of the seven classes.

"Your committee believes that critics generally recognized a marked improvement in the quality of the pictures exhibited by all participants. The increased proportion of bromide and platinum prints was noticeable over former exhibitions, and indicates a change of taste from the warm tones and glossy surface of the albumen print to something more permanent and more pleasing to the eye of the artist. An even greater revolution may be expected within the next year, owing to the introduction of

the cold process in platinotype printing, and in the new toning of plain silver prints with a platinum salt.

"The aristotype and prints made from negatives on orthochromatic dry plates, and prints from celluloid films, were among the newer features of the exhibition. The exhibits of pictures made with detective cameras were interesting in many respects, and no doubt furnish valable studies for an artist, but in close comparison with larger and direct prints from negatives made with time exposure, they suffer in respect to technical qualities and the careful composition so important to a photographic picture. It is to be hoped that the ease and fascination of hand camera work will not induce photographers to neglect the use of the larger plates or films, which, though entailing more cost, care and labor, repay it all in more satisfactory and pleasing results. We are informed by one of our foreign exhibitors that among landscape photographers of England who aspire to pre-eminence in their art, larger plates are now in use than ever before.

"Exhibitions of lantern slides were held upon Tuesday and Thursday evenings of each week. The improvement in the quality of gelatine lantern slides was marked and encouraging; also the uniform size of slides and neatness in mounting, qualities no doubt engendered by the labors of the American Lantern Slide Interchange.

"The local committee in immediate charge of the exhibition were assisted by Messrs. H. T. Duffield, of New York, and E. F. Wilder, of Boston, through their efforts in securing exhibits from their respective cities and societies.

"By special resolution of the Joint Exhibition Council the Board of Judges was to consist preferably of 'three artists of acknowledged ability, at least one of whom shall be well versed in practical photography, and two expert practical photographers.' The committee of arrangements selected for this purpose the following gentlemen: John C. Browne, Geo. W. Hewitt, J. B. Sword, Xanthus Smith and Fred. B. Schell.

"Special thanks are due to these gentlemen for their valuable time given to a critical examination of every exhibit, and the most impartial and satisfactory decision rendered by them. Mention must be made of the kind and valuable services of Mr. Frank Bement in loaning and operating his oxyhydrogen lantern, and Messrs. Geo. B. Wood, Geo. Vaux, Jr., H. H. Suplee and Dr. C. L. Mitchell, who very kindly described the lantern slides upon the various nights when they were shown.

"Diplomas were awarded as follows:

DIPLOMAS FOR SPECIAL EXCELLENCE.

"1. For landscape or marine views, Harry Tolley, Nottingham, England, No. 524, 'On the Lonely Shore.'

"2. For portraits, Frederick Gutekunst, Phila., No. 303, miscellaneous portraits.

"3. For *genre* subjects and figure compositions, W. W. Winter, Derby, England, No. 608, 'My Mammy.'

"4. For work by ladies, Mrs. S. M. Cleveland, Philadelphia, No. 311, entire exhibit.

"5. For enlargements, Wm. H. Rau, Phila., Nos. 340 to 343.

"6. For lantern slides, Professor Henry A. Rowland, Johns Hopkins University, Baltimore, Md.

"7. For applied photography, scientific or technical, Professor Henry A. Rowland,

Johns Hopkins University, Baltimore, for photographic maps of the normal solar spectrum, second series, 1888.

DIPLOMAS FOR EXCELLENCE.

"For entire exhibits, Frank M. Sutcliffe, Whitby, England; Wm. Perry, Shields, England; J. P. Gibson, Hexham, England; John Bartlett, Philadelphia, Charles L. Mitchell, M.D., Philadelphia; George B. Wood, Philadelphia; Paul Lange, Liverpool, England; Robert S. Redfield, Philadelphia; Richard Keene, Derby, England; Harry Symonds, Portsmouth, England; S. W. Burnham, Lick Observatory, California, The Rev. F. C. Lambert, M.A., Cambridge, England; H. A. Latimer, Boston, Mass., A. K. P. Trask, Philadelphia; George A. Nelson, Lowell, Mass.; R. T. Hazzard, Philadelphia; Clarence B. Moore, Philadelphia; Mr. and Mrs. Anckhorn, Arbroath, Scotland.

"While the object of the Joint Exhibitions is not that they shall serve as a source of revenue to the societies interested, it is gratifying to your committee to be able to report that the late exhibition was pecuniarily a success.

"The experiment of conducting the exhibitions of photographs in the three cities New York, Boston and Philadelphia annually, and in rotation under the same rules and management, now having been given a trial by each of the societies a proper time has arrived for considering the question of the desirability of a continuation of the plan and agreement. The benefits which have accrued from the co-operation are very apparent; the objects of such exhibitions are identical in each society, and the limitation of one exhibition to each city once in three years keeps fresh and increases the interest taken in them by the public and by contributors.

"The three societies now so fully understand and agree upon the general object of the exhibitions, it may be well before entering upon another three years series for each society to consider whether the plan adopted shall be continued in its present shape of Joint Exhibitions, or whether they would prefer to conduct future exhibitions each under its own rules, confining the agreement simply to holding the exhibitions annually in rotation in one of the three cities under the control of the local organization. If continued as a joint arrangement it would seem desirable that a medal be adopted for distribution at future exhibitions in place of diplomas. A medal is the time-honored token for award in recognition of high merit. It is recognized as such in all countries, and conveys an idea of value and dignity which a mere written document or instrument can never equal.

[Signed] JOHN G. BULLOCK,
ROBERT S. REDFIELD,
SAMUEL M. FOX,
Committee on Joint Exhibition.

The treasurer's report showed a balance to be placed to the credit of the Society over and above all expenses on account of the exhibition of about $250.00.

On motion of Mr. Wood the report was accepted, and the funds in the hands of the committee were ordered to be turned over to the treasurer.

Dr. Mitchell moved that a vote of thanks be tendered to the committee for their labors on behalf of the Society, and also to the Board of Judges for their efficient and valuable services. Carried.

Mr. Bullock, for the committee, also reported that the exhibits of Messrs. W. W. Winter, of Derby, and Mr. Auty, of Tynemouth, England, had been presented to the Society, for which votes of thanks were passed.

Mr. J. G. Martin showed one of Beck's new combination lenses, arranged for foci of 5, 7, and 9 inches, and for plates from 4 x 5 in. to 5 x 8 in. He also showed a small lens of 4 in. focus, and a wide angle lens 11 in. focus, for 14 x 17 plates. All of these lenses were supplied with the Iris diaphragm.

A number of excellent pictures made with the use of Pine's flash-light apparatus were also shown by Mr. Martin.

Dr. Mitchell described two brands of Aristotype paper, with which he had been experimenting; one of American make, coated, he believed, with a collodion emulsion, and a foreign paper coated with gelatine. He illustrated his remarks with several prints made on the two varieties of paper.

Mr. Graff showed a circular which was of interest in connection with the revival in the use of magnesium light in photography. It was dated March 18, 1869, and consisted of an invitation to be present at a practical test of "Proctor's Patent Night Photography Invention," a description of which would be found on page 38 of the February, 1869, number of the *Philadelphia Photographer*. A cut on the circular showed a tent-like structure, forming an apartment in which the sitter was evidently placed and illuminated by the burning magnesium. Through a large, round opening in the end of the tent a portrait camera was pointed, with which the picture was taken.

He also showed some interesting prints, made by Tabor, of San Francisco, of an eclipse of the sun.

Adjourned.

ROBERT S. REDFIELD, *Secretary*.

THE ART OF RETOUCHING.

A Communication to the Birkenhead Society.

THE value of retouching as an aid to the practice of photographic portraiture is now so universally recognized, that no effort of mine is needed in order to prove its practical utility.

The term retouching is somewhat a misnomer. It implies the *continuation* of some process or method of touching, which really is not the case. The words "photo-modeling" would, I think, be far more suggestive and helpful to the uninitiated.

The object of retouching cannot be too clearly stated. It is not to make poor negatives good (though to a certain extent it will do this); it is rather to make good negatives perfect. Under-exposed or over-exposed negatives will always give unsatisfactory results, even though they be worked on by a skillful retoucher. What is really needed is that portraits shall be well lighted, well timed in exposure, carefully developed, and judiciously retouched. The result will then be perfect.

I have hinted that it is almost impossible to get a truthful and pleasing portrait by purely photographic means. Unfortunately the art does not lend itself to the reproduction of color, a fact which accounts for many blemishes in the photographic

negative. For instance, fair-complexioned people with ruddy faces have a tendency to photograph dark; other light-colored skins are covered with freckles, which, being yellow in colors, are invariably reproduced as so many black spots; temporary pimples and blotches are reproduced in like manner; whilst wrinkles and facial lines are often so exaggerated as to appear most objectionable.

All these defects may be completely removed by the judicious use of a sharp-pointed lead pencil. The transparent parts of a negative which indicate the ruddy cheeks of a fresh complexion may be filled up by carefully interweaving pencil lines until it is brought into harmony with the surrounding parts. Freckles, pimples and blotches may be obliterated by light touches, and wrinkles and lines may be softened in like manner. This part of the work is generally known as "smoothing" the face, and is the least important part of the retoucher's work. That which exercises his skill in a far greater degree, and which requires more than an ordinary amount of artistic knowledge, is what is called "modeling the face," by which means the high lights, half tones, and deeper shadows are brought into harmony the one with the other, making the resulting portrait pleasing and effective, and in accordance with the artistic laws that govern light and shade. To do this effectually requires a close examination of the portrait negative previous to commencing operations. Should the high lights appear flat, it will be necessary to build them up with pencil until a natural effect is produced. A corresponding amount of attention must also be paid to half tones and shadows, the former being treated most delicately at all times.

The principal lights are the top of the forehead, over the eyebrows, the bridge of the nose, and the cheek-bone. The middle tints and deep shadows are indicated in every negative, and consequently do not need description.

The value of retouching in connection with expression in photographic portraiture cannot be overestimated. It very frequently happens that a cross look is caused by knitting the brow, which produces lines between the eyes. The softening of these lines by retouching almost invariably produces a result that, compared with a print from the same negative before being so dealt with, is simply marvelous. Again, the lines of the mouth when drawn down very often cause a sarcastic expression, or if drawn up produce a grin; but, if these be carefully softened down by retouching, pictures which would otherwise be considered valueless will be carefully treasured as pleasing and truthful portraits.

The novice in the art will naturally desire to produce such results with as little delay as possible, and it most frequently happens that beginners endeavor to fill up *all* the lines in the face with a view of producing a clean, marbly effect, which, through want of knowledge, they consider the highest flight of the retouching art. A greater mistake could not be made. In no instance should the individuality of any portrait be lost. Perhaps this phase of our subject is the most important, for what *not* to do is even of greater moment than *what* to *do* in the endeavor to produce a faithful portrait. For instance, if the lines in an aged person's face were filled up it would probably make them appear young, and only the outlines of the face would be recognizable; or, again, if the hollow cheeks of a thin-faced person were so worked on as to produce the effect of one in full flesh, as a portrait such a picture would be worthless. It cannot, therefore, be too strongly urged that in every retouching effort nothing should be done that will in any way interfere with the production of a truthful portrait. Tone down exaggerated lines, take away altogether such blemishes as

are not permanent, build up the lights, and improve in every respect where faults are due to defective photography, but in no case endeavor to make the old look young, or the ugly pretty; for however much we may flatter ourselves or seek to flatter others, the truth is strong, and in the long run must prevail.

W. WILKINSON.

THE CINCINNATI CAMERA CLUB.

CINCINNATI, May, 1889

THE first meeting of the month was held at the rooms of the club, Monday evening, May 6th, Mr. Bullock in the chair. In the absence of the Secretary the minutes were omitted, and Mr. Kelley appointed Secretary *pro tem.* One new member was elected. A motion prevailed as the sense of the club that its interest would be best subserved by a declination of prizes of money value to members for work done on the annual excursion. A suggestion was adopted that the excursion committee offer diplomas for two or more grades of work done on the annual excursion, and that prints of the same be framed and hung in the club rooms with proper mention. Mr. Bullock, after addressing the committee on the work expected of them, read a paper on composition generally, and the duties of the Exhibition Committee specifically, especially with reference to lantern slides. The paper was intelligently and carefully prepared, and was well received, although not altogether concurrently. The subject started a lively discussion, and more may be expected from it. The reports of Treasurer and Librarian showed the club to be in general good condition, 45 new members received during the year, making a total to date of 118.

At the close of the meeting refreshments were served to the members and their friends, making the evening one of pleasure as well as profit. The second meeting of the month, May 20th, opened with the President and Secretary in their places. Two members were elected.

The Excursion Committee stated their arrangements for the outing on May 30th. Mr. Kelley read a paper following the papers of Messrs. Johnson and Bullock at previous meetings. Mr. Bullock had maintained that general interest in the picture should determine whether it should be publicly exhibited. Mr. Kelley, not ignoring the interesting, thought that selections should be governed by the technical and general excellence of the photograph as well. These papers provoked a good-natured and desirable discussion. Dr. Le Boutillier followed, advancing the merit of pictures with life in them because they were apt to meet applause. Mr. Fisher advanced novelty as a very desirable feature. Mr. Peck heretically advanced the view that we cannot all be great artists; if the photograph is good, and the maker and his friends are satisfied with it, it ought to be accepted. Mr. Johnson, not disputing any one, thought the exhibitions each year should show study and improvement as to general excellence. The chairman of the Exhibition Committee rose to move the thanks of the club to Mr. Kelley and the members taking part in the discussion, give assurance that each and all the ideas advanced would be considered in their selections. The Chicago slides were shown at the close of the discussion, following which Mr. Prince gave practical demonstrations with positive films. Mr. Bullock also showed samples of his work with same. At a late hour the meeting adjourned.

H. E. FITHIAN, *Corresponding Secretary.*

BOOK NOTICES.

THE CHEMISTRY OF PHOTOGRAPHY. By Raphael Meldola, F.R.S. Crown 8vo. Pp. xiv. and 382. London and New York: Macmillan & Co. Philadelphia: J. B. Lippincott Co.

In this book is published a series of lectures delivered by the author in the Finsbury Technical College before an audience composed of chemical students and practical photographers. The book is not a collection of laboratory formulas, nor a chemical history of the substances used by the photographer, but the principles underlying photography and photographic methods are developed in such a manner that anyone interested in the art, be he amateur or professional, will feel himself amply repaid for the time spent in its study.

The first lecture is devoted to definitions, and the consideration of photo-chemical and photo-physical changes. Here we may say the author has not been especially happy in some of his examples of photo-physical change. The atmospheric modification of phosphorus and insoluble sulphur are quite distinct chemically from the other varieties of the same elements in the structure of the molecules of the substance, if the chemical properties of the substance confer chemical identity.

Photo-reductions, photo-dissociations and oxidations are then discussed. The photo-chemistry of the silver compounds is developed in the second lecture. The nature of the change in the silver haloids is considered, and the author gives the credit to the works of Abney, Hunt, and Carey Lea. He inclines, however, to an unpublished theory of Dr. W. R. Hodgkinson that the photohaloids are oxyhaloids of the formula

$$O \left\{ \begin{matrix} Ag^2\ X^1 \\ Ag^2\ X^1. \end{matrix} \right.$$

The succeeding chapters up to the 7th lecture follow the the theory of the action of sensitizers. This is, perhaps, the best of the lectures, the subject being treated historically,—emulsion photography, theory of developers, destruction of the invisible image, and reversal of the image, or solarization. The last two phenomena, which are so curious, even unintelligible, to the empiricist, are explained and illustrated so simply that comparatively little chemical knowledge is required for the comprehension of the beautiful theory involved.

The seventh lecture is concerned with the spectrum the photo-chemical effects of various parts of the spectrum on the silver haloids. Here is demonstrated the relation of various conditions of the spectrum to reversal of the image, as well as reversal by oxidants and other agents.

Then follows a discussion of the relation between photo-chemical decomposition and absorption of light—Draper's law,—and a brief statement of the requirements and conditions of orthochromatic photography.

The ninth and last lecture treats of fixing, intensifying and weakening of the negative, and of the chemistry of the various printing processes, including toning.

Every point taken in the lectures is fully illustrated by simple experiments that can be repeated without great difficulty. We commend the book to all who would combine a knowledge of the science of photography with the practice of its art, and we feel confident that much useless experiment may be avoided by acquiring familiarity with first principles. The persevering student can then combine induction with deduction, and his experiments being based on a sure foundation, will more likely attain the desired result.

UBER AEHNLICHKEIT IN DER PORTRAIT PHOTOGRAPHIE. Von Hans Arnold, Verlag von K. Schwier, Weimar.

The work before us is the first of a series called the German Photographic Library, issued by the *Photographische Zeitung*.

The subject is treated in the German exhaustive method, and gives evidence of much careful thought by the author, who is evidently a practical worker. The theme is "Likeness in Portraiture."

Mr. Arnold is one who believes that, while a portrait must depict considerable of our earthy nature,—the quality of faithful likeness,—it must also mirror the soul in the face. We must look for the character in expression, and not judge of the traits of the man by generalizing on his features.

The permanent characteristics which indicate the disposition and the habits of the real self can only be secured by the study of character. He contends that the operator must be a man of refined tastes, and should train his powers of ob-

servation. Wherever he goes he should keep his eyes open to acquire something new in his profession, so that when a subject is before him he may at once discern the true inwardness of the man, and adapt the mechanical appliances and arrangements to the accomplishment of his set purpose,—to give a truthful likeness of the individual.

The author devotes a considerable portion of the book to the discussion of the lawful application of retouching for the securing of artistic effects.

His remarks are just and temperate, and may be read with advantage by those who go to the extremes when treating of the process of retouching.

NOTES.

WE have received the illustrated catalogue of the Fifth Annual Exhibition of Photographs by the Providence Camera Club. An enumeration is given of over two hundred pictures, besides lantern slides. This club has made great progress since its foundation in 1883.

In the fall of 1884 the Association gave an exhibition of pictures, showing results of its summer work. This proved a gratifying success, and established the custom of giving an exhibition each year to show the advancement made by the members. Succeeding exhibitions have shown that the members have kept pace with the rapid advance in photographic methods, and while following the technical part closely, at the later displays many really artistic pictures were exhibited.

The possibility of amateur photographers making lantern slides has been proved by the successful exhibition illustrating Narragansett Bay given last winter, at which about double the number of slides needed was offered. The facilities which are now provided in the new dark room promise an extensive future in this interesting branch of the art.

The rooms which this exhibition opens offer accommodations long desired by the amateur photographers of Providence and vicinity. The club room is amply lighted for portraiture, and necessary accessories will be provided, which will no doubt stimulate this particular line in picture making. At one end of the room is a permanent hard finish wall screen upon which to project lantern slides; for this purpose the Club hopes, at no distant day, to have a lantern of its own; until such time the deficiency will be met by the members who already possess lanterns. In this room a reading table will be supplied with the leading photographic publications.

The dark room was the most important feature of the accommodations. It is protected by double doors, so that entrance may be had any time without admitting white light. The arrangements for lighting have received careful attention. Three windows in the partition, immediately above and in front of the developing sink, are glazed on the outside with ruby glass, and on the inside with plain glass, forming a pocket several inches deep; in this pocket three screens covered with orange paper are hung with counter weights, allowing the operator to modify the light at will. These screens, in connection with the ruby light, give a safe and pleasant illumination of the dark room. The source of light is a row of incandescent electric lamps encased on the outside of the ruby glass, so that their light will shine only into the dark room. The use of artificial light gives a uniform illumination at all times. The developing sink of soapstone is large and deep, and provided with washing boxes and an ample supply of water. On the side opposite the sink is a series of lockers for the use of the members. In the window at the east end of the room is placed an enlarging camera and easel. It is believed this apparatus will prove a valuable acquisition to the Club, and that the mechanical difficulties of making lantern slides and enlargements will be reduced to a minimum.

Already plans are being devised for the coming season's work and meetings; one of these is the organization of a regular system of exchange of lantern slides between the New England Photographic Societies, thereby giving each club opportunity of examining and enjoying the work of other clubs. This project has received the endorsement of several of the societies, and will become an established fact soon. The officers of the Club are:

OFFICERS, 1889.—Mr. R. Clinton Fuller, President; Mr. L. L. Anderström, Vice-President; Mr. J. Eliot Davison, Secretary-Treasurer; Mr. Arthur B. Ladd, Librarian.

EXECUTIVE COMMITTEE.—Messrs. R. C. Fuller, J. E. Davison, Chas. R. Ferris, L. L. Anderström, Henry J. Reynolds, Benjamin Smith.

THE June *Connoisseur* has a phototype in green tint for frontispiece, representing a vexed beauty of the eighteenth century, entitled "Chagrin d'Amour," from the painting by Jacquet. Henry Havard's instructive article on "Transformations of the Timepiece," with numerous illustrations of handsome clocks, is concluded. "The Technical Art of Japan" is an interesting survey of a subject of growing importance here. An article on American silverware by R. Narrdoi is in the style of Mr. R. Riordan, of whose name we notice Narrdoi is an anagram. Eugene von Jagow, one of the most entertaining of Paris litterateurs, contributes lively gossip concerning Paris Theatres and the Hotel de Ville. The contents of this number are on a very high plane indeed. BAILEY, BANKS & BIDDLE, Twelfth and Chestnut Streets, Philadelphia. 50 cents a year. *The Connoisseur* is the best and the cheapest magazine of its kind published.

THE International Annual of *Anthony's Photographic Bulletin* gives us an early and abundant harvest of rich productions from the fields of photographic experience. Amongst the names of the usual contributors to photographic periodicals we notice some new ones, whose excellent papers we welcome.

The Editors, Dr. Elliott and Mr. Harrison of England, merit praise for their care and judgment in selection of the rich material presented to them, by which the annual is made even better than was the excellent initial volume of last year.

NOTWITHSTANDING the variety of opinion provoked by the appearance of Dr. Emerson's work, "Naturalistic Photography," it has won a wide circulation. We learn that the English edition by Sampson Low & Co., London, is exhausted, and that a new one is about to appear. The American edition of Spon, of New York, is rapidly becoming scarce.

THE novel and interesting investigations by means of photography and the flash-light of the phenomena attending the growth of the night-blooming Cereus, by Mr. Julius F. Sachse, of Philadelphia, which were first communicated to the AMERICAN JOURNAL OF PHOTOGRAPHY, November, 1888, have excited much attention amongst biological students throughout the world. The paper was reprinted by various scientific and photographic publications, with reproductions of the photographic illustrations. A very interesting account is published in the *Photographic News*, of London, of the repetitions of Mr. Sachse's experiment, and of the verification of his theory of growth. Mr. Sachse expected to complete his studies of the Cereus this Spring, but his plants not producing sufficient vigorous efflorescence, he will be obliged to defer the experiment to the time of the next flowering. He has, however, reproduced some of the members of the Cereus, and prepared a number of excellent photographs, which demonstrated the rapidity of movement during the evolution of the flower, as well as the change in direction.

DR. LIPPMAN, in *Comptes Rendus*, speaks of having obtained excellent results in translation of tone values of reds and blues and greens by simply exposing a plate successively to the light transmitted through colored glass. No mention is made of staining the film.

CHILDREN of the present generation early become independent and able to rely upon themselves, but we have found a very prodigy in matters photographic. Taking views with a detective camera in the streets of London at eleven years of age, unattended by any grown person, savors strongly of independence and advance. We this week met a bright, intelligent lad of eleven summers starting out to work a detective camera; we have not seen the pictures that he took, but we feel sure in the near future he will be a competitor for our prizes in the juvenile class. English boys, look to your laurels; this lad hailed from Philadelphia.—*Amateur Photographer, London.*

MR. JOHN CARBUTT deserves great praise and the rich thanks of traveling photographers for introducing the light and beautiful celluloid film.

We recently made a number of exposures on interiors by flash light, using his celluloid films, 8x10. We were delighted with the results. Not an opaque spot or speck marred the beautiful, clear negatives. We are sure that a few bubbles or striæ would have obtruded themselves if we had used glass plates.

A GOOD deal of taste and judgment is necessary in the selection of the mount most appropriate to the character of the photographic print. We agree with Mr. Graham Balfour, of London, when he says that it is a mistake to surround a print with so large an area of white

card as to kill the brilliancy of the high lights in the picture, or with so large a space of dark color as to destroy the force of the shadows.

He regrets that manufacturers allow such a narrow margin in delicacy of tints in sections of cards that one is obliged to procure his own card board if desirous of having his picture show to the best advantage.

We have often spoken of this general indifference of American photographers in selection of appropriate mounts, and have endeavored to show that the bad features in a photograph are often emphasized and the good almost lost by improper tint in the mount, but we have no cause like Mr. Balfour to blame our manufacturers of card board.

We have often been delighted with the rich range and variety of soft neutral tints in card board presented by the enterprising A. M. Collins Mfg. Co., of Philadelphia, and have only regretted that photographers will not avail themselves of the privilege in selection. We are sure our artistic friends in England would rejoice in the wealth of material.

PHOTOGRAPHS of medals and coins are not always so satisfactory, when taken by many photographers, as could be desired. They are by no means easy subjects to depict photographically. Excellent photographs of them, however, are to be frequently met with in some of the publications in which numismatology is made a feature. It may not be generally known that these photographs are rarely, if ever, taken direct from the coins themselves, but from plaster of paris casts, made specially for the purpose. The plaster employed is slightly tinted with burnt sienna, or similiar pigment, to destroy its excessive whiteness, and thus render the casts specially suited to photography. This will fully account for the difference in the published photographs of this class of subject as compared with the work of an ordinary photographer when he is suddenly called upon to photograph the metallic articles themselves, as he frequently is with prize medals, for advertising purposes. When gold, silver, and bronze medals or coins have to be included in the same negative, and plaster casts of them are prepared, a difference should always be made in tinting the plaster. The casts from the silver should be made lighter, and those from the bronze darker than the gold ones.

MANY a photographer has rejoiced in the convenience and diminution of weight in apparatus afforded by the excellent device of the Eastman Dry Plate and Film Co., Rochester, N. Y., in their roll holder attachment, by which a ribbon of films can be carried sufficient for a great number of exposures.

The only drawback to the general application of the roll holder was the additional labor entailed in stripping the film from the paper substratum. The process of stripping, though nothing serious to practical photographers, offered some difficulty to the amateur, and made him hesitate some time in his decision between light film and heavy glass, but there is now no longer any need of weighing the matter. The enterprising company has succeeded in making a film so flexible that it can be rolled like paper, in transparency for all practicable purposes as good as glass, and which requires no stripping, the photograph being taken directly upon its surface.

We have no doubt of the great popularity of the new flexible film, which is possessed of all the advantages of glass plates without any of the disadvantages, is easy of transportation, and capable of giving the best results.

To the photographic tourist just now this invention will be hailed as a boon. We understand it is also adapted to the wonderful little Kodak camera, which will now be more famous than before.

A CONTEMPORARY gives the following:

Red and green fog, sometimes seen in pyro-developed plates, it is said may be avoided by washing the plate for a minute, after development, in pure water, and then leaving it for twenty to forty seconds in a two per cent. solution of chloride of iron, and putting *it directly, without washing*, from this into the pyro.

In our experience the contact of iron salt with pyro always results in the formation of a variety of ink which, coming in contact with the gelatine film, we fear would be a greater enemy to its clearness than even the red and green fog.

Doubtless the last word of the recipe should be hypo instead of pyro. Weak chloride of iron and hypo are often effectual in removing slight traces of fog caused by development. Editors of photographic journals should be careful in revising their proofs, when the difference in the sense of these two words makes a good thing worse than useless.

ON the 22d ult. Mr. Thomas H. McCollin, senior member of the firm of our publishers, was married to Mrs. Lydia K. Richards, of Philadelphia, a lady of literary attainments, and for a long time associated with the editorial staff of *The Friends' Review*. After a reception at their home, the bride and groom started on a wedding trip to Europe to visit the Paris Exposition.

JUNE BARGAIN LIST.

Accessories:

1—Packard Rock 3 00
1—8x11 Exterior Background, light right 8 00
1—Card size Burnisher 3 00
1—Cameo Press 1 00
1—Pharaoh Chair 5 00
1—Rustic Wood Chair 5 00
1 copy Photo Mosaics for 1881, in cloth 50
1 copy Pictorial Effect in Photography 75
1 copy Photo Colorists' Guide, . 75
1 copy About Photography and Photographers 50
British Journal Almanacs for 1889, reduced to 40
1—15-in Entrekin Rotary Burnisher 17 00
1—15-in Entrekin Eureka Burnisher 15 00
1—Lever Camera Stand for 14x17 Camera 10 00
1—Fuming Box 4 00
1—15x18 Deep Porcelain Tray . 3 00
1—15x18 Japan Tray 50
1—Perfect Camera Stand for 8x10 . . . . . 8 00
1—Iron Centre Camera Stand, . 3 00
1—14-in Eureka Burnisher . . 16 00
1—Seavey Swiss Cottage Accessory 12 00
1—8x10 Exterior Ground, good condition, ... 10 00
2—Spencer Head-rests 11 00
British Journal Almanacs for 1878 20
Photo Mosaics for 1883, ... 20
1—8x10 Plain painted ground . 3 00
1—8x10 Osborne's interior background, new, light left . . . 20 00
1—4x8 Osborne's side slip . . . 7 50
Pearl leads, the best retouching point in the market, each . 15
5x8 Woodbury Dry Plates PER DOZ. 80
4¼x6½ " " . . . 65
6½x8½ Triumph " . . . 85
5x7 " " . . . 55
4¼x6½ " " . . . 45
5x8 Neidhardt " . . . 65
4x5 Bridle " . . . 35
1—8x10 Hough's Exterior ground, good as new, light left of sitter 9 00
1—8x10 Hough's Exterior ground, light right 8 00
1—Hough's Oak Stump 7 50
1—Osborne's No. 71 Rock Accessory 9 00
1—Osborne's Bridge Accessory . 8 00
1—Osborne's Gate Combination Accessory, new 18 00
1—5x8 Negative Box 50
3—3¼x4¼ Printing Frames, each 20
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